Progress Report
March 2002

FHWA POOLED-FUND PROJECT NUMBER: ***TPF5-(003)***

TITLE: Extending the Season for Concrete Construction and Repair

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OBJECTIVE: To develop an antifreeze admixture conforming to existing industry standards. This work will adapt recently developed knowledge about off-the-shelf admixtures to the specific conditions of highway construction. The admixture will protect concrete to 23°F (-5°C) or lower and allow concrete to gain appreciable strength while at that temperature.

REPORTING PERIOD: 01 November 2001 through 01 Mar 2002

ITEMS IN THIS ISSUE:

- Funding
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***Funding*:** As we mentioned last time, a total of 10 states have joined as partners in this project. We want to thank all for supporting this effort. Recall that problems with transfer of funds from states to FHWA to CRREL delayed the project start from October 2000 to April 2001. As we near the end of our first year, we have made quite a bit of progress as noted below. The FHWA regional reps for all 10 states indicate that all paperwork has been completed for funding the second year and FHWA should be receiving the funds soon.

CERF: The effort to develop a national standard for antifreeze admixtures took another step. Last week CRREL was part of a conference call with Unisphere, Concurrent Technologies Corporation, and Civil Engineering Research Foundation people. The plan appears to be jelling to begin dialog with standards writing organizations and with admixture manufacturers. It's taken us two years to get this far and it'll probably take several more years before we see a standard for antifreeze admixtures like those now in place for water reducers and accelerators. Meanwhile, we'll all soon be working with antifreeze technology using current off-the-shelf materials.

Lab Results: In our last progress report we indicated that we had developed 4 admixtures combinations that seemed to perform well in concrete under laboratory conditions. The admixtures did not cause the concrete to lose slump too rapidly, produced reasonable setting times, and allowed the concrete to gain significant strength at low temperature. These 4 combinations were developed to produce concretes with

different setting times—from those that set slowly and remain workable for more than an hour to those that set rapidly and lose workability within 20 minutes. The setting times also related directly to how rapidly the concretes gain strength. Up to this point, all attention was devoted to admixtures from W.R. Grace. We turned our attention to the second, and last, group of admixtures—from Master Builders.

Field Success: Because we were in the winter season, we also turned our attention to conducting two field studies. We had two successes. In December, 2001 one of the four mixes was used to repair a section of interstate bridge in northern NH, showing that not only can concrete cure in the cold, but that it is feasible to do such work in the cold. This project used Type I/II cement at 658 pcy. In February, 2002 a section of concrete highway was replaced with another one of our concretes. This concrete, a fast curing variety, allowed the road to be reopened to traffic within 48 hours. It used Type I/II cement at 800 pcy. Rather than write any more about them here we direct your attention to our web site for detailed information on each project.

- First field project, NH, December 2001: http://www.crrel.usace.army.mil/concrete/NH_Field_Demonstration.htm
- Second field project, WI, March 2002: http://www.crrel.usace.army.mil/concrete/Wisconsin_Demo/Wisconsin_Field_Demo.htm

Looking ahead: We plan to complete our investigation of the Master Builders admixtures before summer. We also plan to develop data on setting time, workability, freeze protection limits, maturity testing, freezing point measurements, and freeze-thaw studies for concrete made with the admixture combinations we derive. This summer we will begin developing the protocol so that the participating states can design, mix, place, and cure antifreeze concrete in below-freezing weather.

Next winter gives us the opportunity to build on the successes of this year. Our schedule calls for a demonstration project of some sort. Based on what we know now, it would be wise to concentrate on the process of pre-testing mixes, on quality control of the concrete, and on coordinating a project in cold weather. The project should require enough concrete to use two trucks to deliver it to the site. This will expose any weakness in multiple batchings without getting over extended. Each truck will be limited to half capacity, as some of our mixes tend to lose slump quite rapidly.

What we need from you: We'd like several states to volunteer to coordinate the efforts for our demonstration project next winter. We'll choose the site that offers the most benefit to all of us. The project should not be on a critical path or be a critical element in your project, as the weather is unpredictable—we may not get the work done on schedule if warm weather set in for a time. Another reason for not selecting a critical project is that we are still conducting an experiment. We welcome both NH and WI to volunteer for a second round as we could build on what was learned this year. Please start thinking about next year and let us know by summer if you have a demonstration site for us to consider.